

Claims

1-6. (Cancelled)

7. (Currently Amended) A seamless expandable oil country tubular article comprising: on a mass percent basis, about 0.010% to less than about 0.10% of C, about 0.05% to about 1% of Si, about 0.5% to about 4% of Mn, about 0.03% or less of P, about 0.015% or less of S, about 0.01% to about 0.06% of Al, about 0.007% or less of N, and about 0.005% or less of O; at least one of Nb, Mo, and Cr which are contained in the range of about 0.01% to about 0.2% of Nb, about 0.05% to about 0.5% of Mo, and about 0.05% to about 1.5% of Cr, so that equations (1) and (2) are satisfied; and Fe and unavoidable impurities as the balance:

$$\text{Mn} + 0.9\text{Cr} + 2.6\text{Mo} \geq 2.0 \quad (1)$$

$$4\text{C} - 0.3\text{Si} + \text{Mn} + 1.3\text{Cr} + 1.5\text{Mo} \leq 4.5 \quad (2)$$

wherein the steel article has a microstructure that contains soft ferrite at a volume fraction of about 5% to about 70% and the balance substantially composed of ~~a low temperature transforming phase~~ bainitic ferrite, bainitic martensite, bainite or mixtures thereof.

8. (Previously Presented) The article according to claim 7, further comprising, instead of a part of Fe, at least one of about 0.05% to about 1% of Ni, about 0.05% to about 1% of Cu, about 0.005% to about 0.2% of V, about 0.005% to about 0.2% of Ti, about 0.0005% to about 0.0035% of B, and about 0.001% to about 0.005% of Ca.

9. (Currently Amended) A seamless expandable oil country tubular article comprising: on a mass percent basis, about 0.010% to less than about 0.10% of C, about 0.05% to about 1% of Si, about 0.5% to about 4% of Mn, about 0.03% or less of P, about 0.015% or less of S, about 0.01% to about 0.06% of Al, about 0.007% or less of N, and about 0.005% or less of O; at least one of Nb, Mo, and Cr which are contained in the range of about 0.01% to

about 0.2% of Nb, about 0.05% to about 0.5% of Mo, and about 0.05% to about 1.5% of Cr, so that equations (3) and (4) are satisfied:

$$\text{Mn}+0.9\text{Cr}+2.6\text{Mo}+0.3\text{Ni}+0.3\text{Cu}\geq 2.0 \quad (3)$$

$$4\text{C}-0.3\text{Si}+\text{Mn}+1.3\text{Cr}+1.5\text{Mo}+0.3\text{Ni}+0.6\text{Cu}\leq 4.5 \quad (4)$$

wherein the steel article has a microstructure that contains soft ferrite at a volume fraction of about 5% to about 70% and the balance substantially composed of ~~a low temperature transforming phase~~ bainitic ferrite, bainitic martensite, bainite or mixtures thereof.

10-14. Cancelled

15. (Currently Amended) A method for manufacturing a seamless expandable oil country tubular pipe comprising:

heating a raw material for a steel pipe, the raw material containing, on a mass percent basis, about 0.010% to less than about 0.10% of C, about 0.05% to about 1% of Si, about 0.5% to about 4% of Mn, about 0.03% or less of P, about 0.015% or less of S, about 0.01% to about 0.06% of Al, about 0.007% or less of N, and about 0.005% or less of O, at least one of about 0.01% to about 0.2% of Nb, about 0.05% to about 0.5% of Mo, and about 0.05 to about 1.5% of Cr, optionally, at least one of about 0.05% to about 1% of Ni, about 0.05% to about 1% of Cu, about 0.005% to about 0.2% of V, about 0.005% to about 0.2% of Ti, about 0.0005% to about 0.0035% of B, and about 0.001% to about 0.005% of Ca, so that equations (3) and (4) are satisfied, and Fe and unavoidable impurities as the balance;

forming the pipe by a seamless steel pipe-forming process which is performed at a rolling finish temperature of about 800°C or more; and

optionally, performing normalizing treatment after pipe forming is performed by the seamless steel pipe-forming process:

$$\text{Mn}+0.9\text{Cr}+2.6\text{Mo}+0.3\text{Ni}+0.3\text{Cu}\geq 2.0 \quad (3)$$

$$4\text{C}-0.3\text{Si}+\text{Mn}+1.3\text{Cr}+1.5\text{Mo}+0.3\text{Ni}+0.6\text{Cu}\leq 4.5 \quad (4)$$

such that the steel pipe has a microstructure containing soft ferrite at a volume fraction of about 5% to about 70% and the balance substantially composed of ~~a low temperature transforming phase~~ bainitic ferrite, bainitic martensite, bainite or mixtures thereof.

16. (Previously Presented) A method for manufacturing a seamless expandable oil country tubular pipe comprising: after heating of the raw material according to claim 15 is performed and pipe forming is performed by a seamless steel pipe-forming process, holding the pipe in a region of from point A₁ to point A₃ for about five minutes or more as a final heat treatment, and then air cooling the pipe.

17. (Previously Presented) The article according to claim 9, further comprising, instead of a part of Fe, at least one of about 0.05% to about 1% of Ni, about 0.05% to about 1% of Cu, about 0.005% to about 0.2% of V, about 0.005% to about 0.2% of Ti, about 0.0005% to about 0.0035% of B, and about 0.001% to about 0.005% of Ca.